Chapter 4

The Repair/ Renovation of S&E Research Space

Highlights . . .

- Expenditures to repair/renovate science and engineering (S&E) research facilities costing over $100,000 increased between fiscal years 1992-1993 and 1994-1995, from $905 million to $1.1 billion in constant dollar terms.
- Repair/renovation expenditures as a proportion of total capital expenditures (construction and repair/renovation) has increased steadily since the 1990-1991 fiscal years.
- In fiscal years 1990-1991, total repair/renovation costs represented 25 percent of all capital project spending. In fiscal years 1994-1995, repair/renovation expenditures accounted for 30 percent of total capital project expenditures.
- Approximately 31 percent of all repair/renovation expenditures for fiscal years 1994-1995 occurred in the two S&E fields within medical schools: the biological sciences and the medical sciences. These expenditures totaled $327 million.
- For fiscal years 1996-1997, institutions were scheduled to spend $1.3 billion to repair/renovate existing S&E research space and $477 million to repair/renovate the central campus infrastructure.
- Forty-five percent of all research-performing colleges and universities undertook some type of repair/renovation project costing over $100,000 during fiscal years 1994-1995.

Background

Rapid changes in science and technology, coupled with deferred renovation to S&E facilities in the 1980s and 1990s, have raised concerns about the quality of S&E research space. The previous chapter revealed a decline in spending to construct S&E research space between fiscal years 1992-1993 and 1994-1995. Here, we examine the extent to which research-performing colleges and universities were engaged in the repair/renovation of S&E research space (and the fields in which this activity occurred).

The Survey Questions

Institutions were asked to estimate the research-related costs and space for repair/renovation projects begun during fiscal years 1994-1995, and to make the same estimates for projects scheduled to begin in fiscal years 1996-1997. The project start-up time was defined as the fiscal year in which actual work began (or was expected to begin). In the case of projects conducted over many years, total project costs were allocated to the fiscal year in which the repair/renovation began.

The reported costs, defined as the cost to complete a project, included planning, site preparation, fixed equipment, non-fixed equipment costing $1 million or more, and building infrastructure. Projects over $100,000 and under $100,000 were reported separately. If a project was to serve both research and nonresearch purposes, repair/renovation costs and space estimates were to be prorated to reflect the research-related portion of the cost (see Items 4a and 4b in Appendix C).

Data Considerations

Data reflect the extent of repair/renovation activity underway in fiscal years 1994-1995. Tables that report expenditures or costs over time are presented in constant dollars; current dollar tables are found in Appendix F. Constant dollars are inflation-adjusted dollars and compensate for variations in the purchasing power of the dollar over time.

The specific deflator used in this report is the Bureau of the Census Composite Fixed-Weighted Price Index for Construction, which more closely tracks inflation within the construction industry than does a more general index. The fixed-weighted price index reflects changes in prices and remains unaffected by changes

in the mix of construction projects during any given year. (See Appendix A, "Technical Notes," for further discussion of the price index.)

The 1994 report presented trends in 1993 constant dollars (the first time constant dollars were used in any of the biennial NSF facilities reports). Here, we adjust dollar figures to 1995 constant dollars, meaning that constant dollar figures in the 1994 and 1996 reports cannot be compared directly.

Findings

How Much Did Institutions Spend to Repair/Renovate S&E Research Space?

Expenditures for repair/renovation projects costing over $100,000 increased between fiscal years 1992-1993 and 1994-1995. In fiscal years 1992-1993, all research-performing institutions spent a total of $905 million. In fiscal years 1994-1995, they spent $1.1 billion, an increase of 17 percent. Spending at doctorate-granting institutions increased from $868 million to $981 million. At nondoctorate-granting institutions, spending more than doubled, from $37 million to $77 million (Table 4-1 and Figure 4-1).

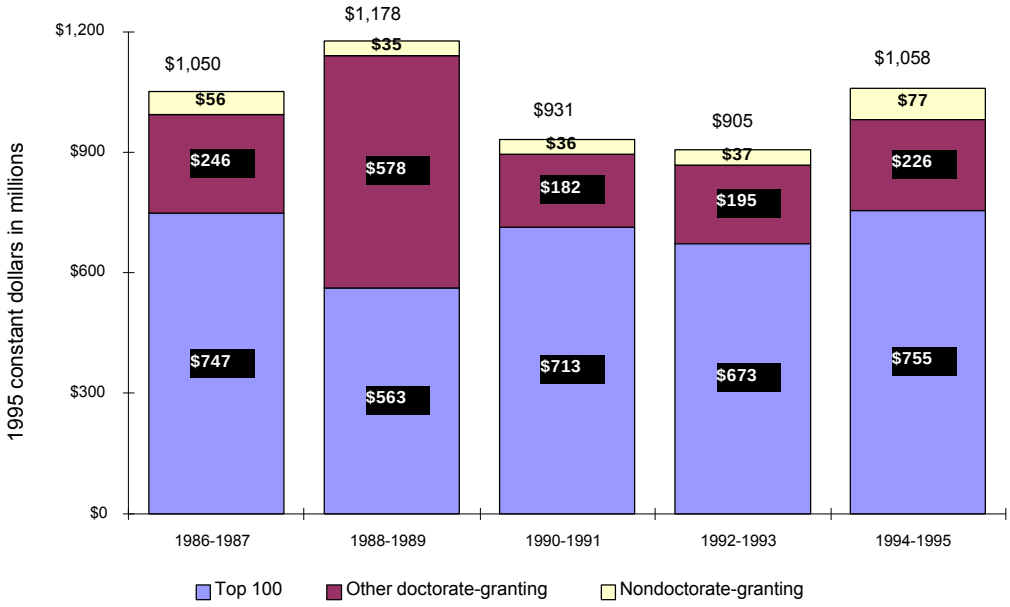
Table 4-1. Trends in expenditures for capital projects costing over $100,000 to repair/renovate science and engineering (S&E) research facilities by institution type: 1986-1995
[Constant 1995 dollars in millions][1]

Institution type	1986-1987	1988-1989	1990-1991	1992-1993	1994-1995
Total	$1,050	$1,178	$931	$905	$1,058
Doctorate-granting	993	1,142	895	868	981
Top 100 in research expenditures	747	563	713	673	755
Other	246	578	182	195	226
Nondoctorate-granting	56	35	36	37	77

[1] Current dollars have been adjusted to 1995 constant dollars using the Bureau of the Census's Composite Fixed-Weighted Price Index for Construction.

SOURCE: National Science Foundation/SRS, 1996 Survey of Scientific and Engineering Research Facilities at Colleges and Universities.

Figure 4-1. Trends in S&E Repair/Renovation Expenditures, by Institution Type: 1986-1995



SOURCE: National Science Foundation/SRS, 1996 Survey of Scientific and Engineering Research Facilities at Colleges and Universities.

While expenditures for repair/renovation costing over $100,000 increased between fiscal years 1992-1993 and 1994-1995, expenditures for S&E research facility repair/renovation projects costing less than $100,000 decreased during this same period (Table 4-2). Total expenditures for repair/renovation projects costing less than $100,000 decreased by 48 percent between fiscal years 1992-1993 and 1994-1995 (from $261 million to $135 million). The sharpest decline occurred at the top 100 doctorate-granting institutions (a decrease of 47 percent, from $194 million in fiscal years 1992-1993, to $102 million in fiscal years 1994-1995).

It is possible that this decline may be attributed to a general rise in the cost of repairing S&E research space over time, making it increasingly difficult for colleges and universities to repair S&E research space for less than $100,000.

Table 4-2. Trends in expenditures for science and engineering (S&E) research facilities repair/renovation projects costing less than $100,000 by institution type: 1990-1995

[Constant 1995 dollars in millions[1]]

Institution type	1990-1991	1992-1993	1994-1995
Total	$164	$261	$135
Doctorate-granting	159	225	129
Top 100 in research expenditures	109	194	102
Other	50	31	27
Nondoctorate-granting	5	36	6

[1] Current dollars have been adjusted to 1995 constant dollars using the Bureau of the Census's Composite Fixed-Weighted Price Index for Construction.

SOURCE: National Science Foundation/SRS, 1996 Survey of Scientific and Engineering Research Facilities at Colleges and Universities.

What Proportion of Total Capital Project Spending Is Represented by Repair/Renovation?

Since the 1990-1991 fiscal years, spending to repair/renovate existing S&E research space has increased faster than spending to construct space. [1] In the 1990-1991 period, total repair/renovation costs--both under and over $100,000--represented 25 percent of all capital project spending, both on construction and repair/renovation. During the next two fiscal years, expenses to repair/renovate existing S&E research space represented 28 percent of total capital project spending. In the most recent time period (1994-1995), institutions spent a total of $1.2 billion to repair or renovate research space, accounting for 30 percent of total capital project funding, or $3.9 billion (Table 4-3).

[1]Trends are reported from the 1990-1991 fiscal years because this was the first time period for which institutions reported repair/renovation expenses both for projects costing over $100,000 and for projects costing less than $100,000.

Table 4-3. Science and engineering (S&E) repair/renovation expenditures as a proportion of total capital project expenditures by institution type: 1990-1995

[Constant 1995 dollars in millions [1]]

Institution type	1990-91			1992-93			1994-95		
	Total Capital Projects	Repair/ Renovation	R/R as %	Total Capital Projects	Repair/ Renovation	R/R as %	Total Capital Projects	Repair/ Renovation	R/R as %
Total	$4,448	$1,095	25%	$4,206	$1,166	28%	$3,951	$1,183	30%
Doctorate-granting	4,261	1,054	25	4,033	1,093	27	3,537	1,100	32
Top 100 in research expenditures	3,100	822	27	3,060	867	28	2,988	847	28
Other	1,163	232	2	973	226	23	683	253	37
Nondoctorate-granting	185	41	22	172	73	42	414	83	2

[1] Current dollars have been adjusted to 1995 constant dollars using the Bureau of the Census's Composite Fixed-Weighted Price Index for Construction.

SOURCE: National Science Foundation/SRS, 1996 Survey of Scientific and Engineering Research Facilities at Colleges and Universities.

Repair/renovation expenditures as a proportion of total capital project spending increased the most in other doctorate-granting institutions between the 1992-1993 and 1994-1995 fiscal years (from 23 percent to 37 percent). In nondoctorate-granting institutions, repair/renovation expenditures, while increasing from $73 million in 1992-1993 to $83 million in 1994-1995, declined as a proportion of total capital project spending (from 42 percent to 20 percent)--a decline that can be attributed to the large increase in construction expenditures in nondoctorate-granting institutions noted in Chapter 3.

How Did Repair/Renovation Expenditures Vary by S&E Field?

Institutions spent more to repair and renovate S&E research space in the medical sciences in medical schools--$226 million--than in any other field during fiscal years 1994-1995 (Table 4-4). Repair/renovation expenditures for the two sciences in medical schools combined (biological sciences and medical sciences) represented approximately 31 percent of all such expenditures in fiscal years 1994-1995. Repair/renovation expenditures for both of these fields, however, were lower in both constant dollar terms and as a proportion of total repair/renovation spending in fiscal years 1994-1995, than in fiscal years 1992-1993.

Other S&E fields in which research-performing institutions spent over $100 million include the physical sciences ($192 million), engineering ($150 million), and the biological sciences outside of medical schools ($127 million).

Table 4-4. Trends in expenditures for capital projects to repair/renovate science and engineering (S&E) research facilities by field: 1986-1997
[Constant 1995 dollars in millions][1]

Field	1986-1987	1988-1989	1990-1991	1992-1993	1994-1995	1996-1997 (scheduled)
Total	$1,050	$1,178	$931	$905	$1,058	$1,258
Biological sciences-- outside medical school	183	147	152	117	127	187
Physical sciences	132	192	170	145	192	241
Psychology	17	13	35 [2]	11	28	29
Social sciences	45	10		11	40	60
Mathematics	5	13	6	2	6	1
Computer sciences	22	11	24	4	8	13
Earth, atmospheric, and ocean sciences	26	21	18	34	35	41
Engineering	176	422	92	150	150	222
Agricultural sciences	25	27	39	15	72	48
Medical sciences-- outside medical school	65	28	59	30	59	65
Medical sciences-- medical school	218	188	187	253	226	132
Biological sciences medical school	97	89	138	125	101	175
Other	38	19	6	8	12	42

[1]Current dollars have been adjusted to 1995 constant dollars using the Bureau of the Census's Composite Fixed-Weighted Price Index for Construction.

[2]Psychology and social sciences were not differentiated in the questionnaire item for the 1990-1991 period.

SOURCE: National Science Foundation/SRS, 1996 Survey of Scientific and Engineering Research Facilities at Colleges and Universities.

How Much Were Institutions Scheduled to Spend on the Repair/Renovation of Existing S&E Research Space and on Central Campus Infrastructure?

For fiscal years 1996-1997, research-performing institutions were scheduled to spend $1.258 billion to repair/renovate existing research space, and $477 million to repair/renovate the central campus infrastructure. Thus, about 27 percent of the total repair/renovation expenditures scheduled for 1996-1997 would be used to repair the central campus infrastructure. Institutions were scheduled to spend more on central campus infrastructure repairs than construction for central campus infrastructure ($477 million versus $245 million). The scheduled repair/renovation of S&E research space, however, was considerably less than that scheduled for construction ($1.3 billion versus $3.1 billion). See Table 3-4 for scheduled

construction expenditures, and Table 4-5, below, for scheduled repair/renovation expenditures.

Table 4-5. Scheduled repair/renovation expenditures for science and engineering (S&E) research space and central campus infrastructure by institution type: 1996-1997
(Dollars in millions)

Institution type	Scheduled Repair/Renovation		
	S&E Research Space	Central Campus Infrastructure	Total
Total	$1,258	$477	$1,735
Doctorate-granting	1,161	449	1,610
Top 100 in research expenditures	889	393	1,282
Other	272	56	328
Nondoctorate-granting	97	27	124

SOURCE: National Science Foundation/SRS, 1996 Survey of Scientific and Engineering Research Facilities at Colleges and Universities.

Repair/renovation expenditures were scheduled to increase over 1994-1995 levels in all types of institutions, in 1996-1997. In the top 100 institutions, the increase would total $134 million (from $755 million to $889 million). Other doctorate-granting universities were scheduled to increase their repair/renovation expenditures by $46 million (from $226 million to $272 million) across these fiscal years, and the nondoctorate-granting institutions indicated an increase of $20 million (from $77 million to $97 million). It has generally been the case, however, that the amount scheduled to repair/renovate existing S&E research space does not always match what is spent.

To What Extent Were Colleges and Universities Involved in Repair/Renovation Projects?

Forty-five percent of all research-performing colleges and universities undertook some type of repair/renovation costing over $100,000, during fiscal years 1994-1995 (Table 4-6). Only 29 percent of all institutions were involved in construction projects during that same period. (See Table 3-5 in Chapter 3 for a comparison of construction and repair/renovation.)

Table 4-6. Trends in the percentage of institutions starting capital projects to repair/renovate science and engineering (S&E) research facilities by institution type: 1986-1997

Institution type	1986-1987	1988-1989	1990-1991	1992-1993	1994-1995	1996-1997 (scheduled)
Total	56%	48%	47%	46%	45%	43%
Doctorate-granting	78	71	74	61	61	55
Top 100 in research expenditures	96	85	91	90	88	78
Other	44	63	65	48	49	45
Nondoctorate-granting	28	20	14	25	24	28

NOTE: As used here, capital projects are repair/renovation projects with prorated costs of $100,000 or more for affected research space. Percentages are based on the number of institutions with some science and engineering research space.

SOURCE: National Science Foundation/SRS, 1996 Survey of Scientific and Engineering Research Facilities at Colleges and Universities.

Similar percentages of institutions undertook repair/renovation projects in fiscal years 1992-1993, and in 1994-1995. In 1992-1993, 46 percent of all research-performing colleges and universities undertook some type of repair/renovation project; during the next two fiscal years, 45 percent were engaged in such projects. Little fluctuation occurred across different types of institutions.

In What Fields Were Repair/Renovation Projects Undertaken?

Repair/renovation projects were more likely to have occurred in some S&E fields than others. Table 4-7 shows that during fiscal years 1994-1995, repair/renovation projects were most likely to have been started within medical schools in either the medical sciences (55 percent) or the biological sciences (46 percent). Research-performing institutions also began repair/renovation projects in engineering (29 percent), the agricultural sciences (27 percent), and the physical sciences (23 percent).

Table 4-7. Trends in percentage of institutions starting capital projects to repair/renovate science and engineering (S&E) research facilities by field: 1986-1997

Field	1986-1987	1988-1989	1990-1991	1992-1993	1994-1995	1996-1997 (scheduled)
Total	56%	48%	47%	45%	44%	43%
Biological sciences-- outside medical school	23	24	22	22	22	19
Physical sciences	22	23	22	22	23	22
Psychology	9	4	10 [1]	4	5	7
Social sciences	8	5		5	8	8
Mathematics	8	8	4	2	3	1
Computer sciences	15	5	10	6	6	4
Earth, atmospheric, and ocean sciences	13	9	13	13	11	13
Engineering	42	37	24	30	29	23
Agricultural sciences	33	25	27	18	27	20
Medical sciences-- outside medical school	12	12	22	16	16	17
Medical sciences-- medical school	54	44	62	61	55	40
Biological sciences-- medical school	45	41	46	39	46	44

[1] Psychology and social sciences were not differentiated in the questionnaire item for the 1990-1991 period.

NOTE: As used here, capital projects are repair/renovation projects with prorated costs of $100,000 or more for affected research space. Percentages are based on the number of institutions with some science and engineering research space.

SOURCE: National Science Foundation/SRS, 1996 Survey of Scientific and Engineering Research Facilities at Colleges and Universities.